EXHIBIT 8

Data-Over-Cable Service Interface Specifications DOCSIS® 3.1

Physical Layer Specification

CM-SP-PHYv3.1-I07-150910

ISSUED

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Document Status Sheet

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Key to Document Status Codes

Work in Progress An incomplete document, designed to guide discussion and generate feedback that may include several alternative requirements for consideration.

Draft A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.

Issued A generally public document that has undergone Member and Technology Supplier review, cross-vendor interoperability, and is for Certification testing if applicable. Issued Specifications are subject to the Engineering Change Process.

Closed A static document, reviewed, tested, validated, and closed to further engineering changes.

Trademarks

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1 SCOPE

1.1 Introduction and Purpose[1]

This specification is part of the DOCSIS® family of specifications developed by Cable Television Laboratories (CableLabs). In particular, this specification is part of a series of specifications that defines the fifth generation of high-speed data-over-cable systems, commonly referred to as the DOCSIS 3.1 specifications. This specification was developed for the benefit of the cable industry, and includes contributions by operators and vendors from North and South America, Europe and Asia.

This generation of the DOCSIS specifications builds upon the previous generations of DOCSIS specifications (commonly referred to as the DOCSIS 3.0 and earlier specifications), leveraging the existing Media Access Control (MAC) and Physical (PHY) layers, but with the addition of a new PHY layer designed to improve spectral efficiency and provide better scaling for larger bandwidths (and appropriate updates to the MAC and management layers to support the new PHY layer). It includes backward compatibility for the existing PHY layers in order to enable a seamless migration to the new technology.

There are differences in the cable spectrum planning practices adopted for different networks in the world. For the new PHY layer defined in this specification, there is flexibility to deploy the technology in any spectrum plan; therefore, no special accommodation for different regions of the world is required for this new PHY layer.

However, due to the inclusion of the DOCSIS 3.0 PHY layers for backward compatibility purposes, there is still a need for different region-specific physical layer technologies. Therefore, three options for physical layer technologies are included in this specification, which have equal priority and are not required to be interoperable. One technology option is based on the downstream channel identification plan that is deployed in North America using 6 MHz spacing. The second technology option is based on the corresponding European multi-program television distribution. The third technology option is based on the corresponding Chinese multi-program television distribution. All three options have the same status, notwithstanding that the document structure does not reflect this equal priority. The first of these options is defined in Sections 5 and 6, whereas the second is defined by replacing the content of those sections with the content of Annex C. The third is defined by replacing the content of those sections with the content of Annex D. Correspondingly, [ITU-T J.83-B] and [CEA-542] apply only to the first option, and [EN 300 429] apply to the second and third. Compliance with this document requires compliance with one of these implementations, but not with all three. It is not required that equipment built to one option shall interoperate with equipment built to the other.

Compliance with frequency planning and EMC requirements is not covered by this specification and remains the operators' responsibility. In this respect, [FCC15] and [FCC76] are relevant to the USA; [CAN/CSA CISPR 22-10] and [ICES 003 Class A] to Canada; [EG 201 212], [EN 50083-1], [EN 50083-2], [EN 50083-7], [EN 61000-6-1], and [EN 61000-6-3] are relevant to the European Union; [GB 8898-2011] and [GB/T 11318.1-1996] are relevant to China.

1.2 Background

1.2.1 Broadband Access Network

A coaxial-based broadband access network is assumed. This may take the form of either an all-coax or hybrid-fiber/coax (HFC) network. The generic term "cable network" is used here to cover all cases.

A cable network uses a tree-and-branch architecture with analog transmission. The key functional characteristics assumed in this document are the following:

- Two-way transmission.
- A maximum optical/electrical spacing between the CMTS and the most distant CM of 50 miles (80 km) in each direction, although typical maximum separation may be 15 miles (24 km).

[1] Revised per PHYv3.1-N-14.1202-3 on 12/11/14 by JB.

- A maximum differential optical/electrical spacing between the closest and most distant modems of 50 miles (80 km) in each direction, although this would typically be limited to 15 miles (24 km).

At a propagation velocity in fiber of approximately 1.5 ns/ft. (5 ns/m), 50 miles (80 km) of fiber in each direction results in a round-trip delay of approximately 0.8 ms. This is the maximum propagation delay assumed by this specification.

1.2.2 Network and System Architecture

1.2.2.1 The DOCSIS Network

The elements that participate in the provisioning of DOCSIS services are shown in the following figure:

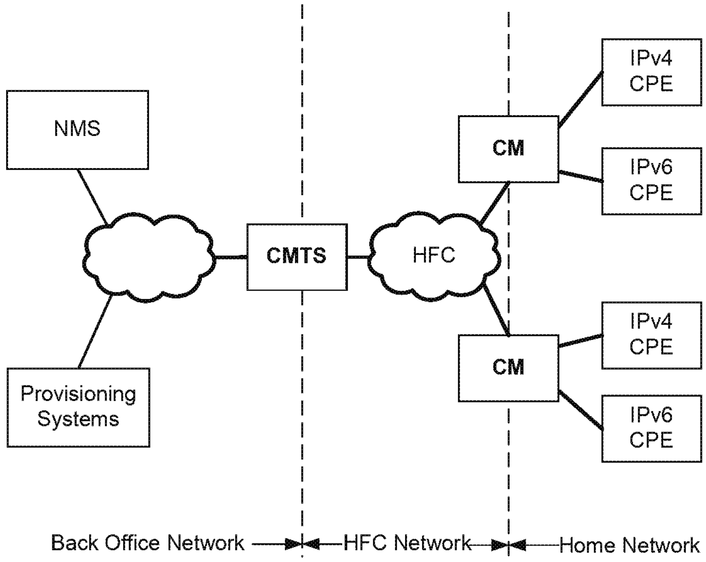

Figure 1-1 - The DOCSIS Network

The CM connects to the operator's HFC network and to a home network, bridging packets between them. Many CPEs can connect to the CMs' LAN interfaces. CPE can be embedded with the CM in a single device, or they can be separated into standalone devices, as shown in Figure 1–1. CPE may use IPv4, IPv6 or both forms of IP addressing. Examples of typical CPE are gateways, home routers, set-top devices, personal computers, etc.

The CMTS connects the operator's back office and core network to the HFC network. The CMTS's main function is to forward packets between these two domains, and between upstream and downstream channels on the HFC network.

Various applications are used to provide back office configuration and other support to the devices on the DOCSIS network. These applications use IPv4 and/or IPv6 as appropriate to the particular operator's deployment. The following applications include:

Provisioning Systems:

- The DHCP servers provide the CM with initial configuration information, including the device IP address(es), when the CM boots.
- The Config File server is used to download configuration files to CMs when they boot. Configuration files are in binary format and permit the configuration of the CM's parameters.
- The Software Download server is used to download software upgrades to the CM.
- The Time Protocol server provides Time Protocol clients, typically CMs, with the current time of day.

- Certificate Revocation server provides certificate status.

Network Management System (NMS):

- The SNMP Manager allows the operator to configure and monitor SNMP Agents, typically the CM and the CMTS.
- The Syslog server collects messages pertaining to the operation of devices.
- The IPDR Collector server allows the operator to collect bulk statistics in an efficient manner.

1.2.3 Service Goals

As cable operators have widely deployed high-speed data services on cable television systems, the demand for bandwidth has increased. To this end, CableLabs' member companies have decided to add new features to the DOCSIS specification for the purpose of increasing capacity, increasing peak speeds, improving scalability, enhancing network maintenance practices and deploying new service offerings.

The DOCSIS system allows transparent bi-directional transfer of Internet Protocol (IP) traffic, between the cable system headend and customer locations, over an all-coaxial or HFC cable network. This is shown in simplified form in Figure 1–2.

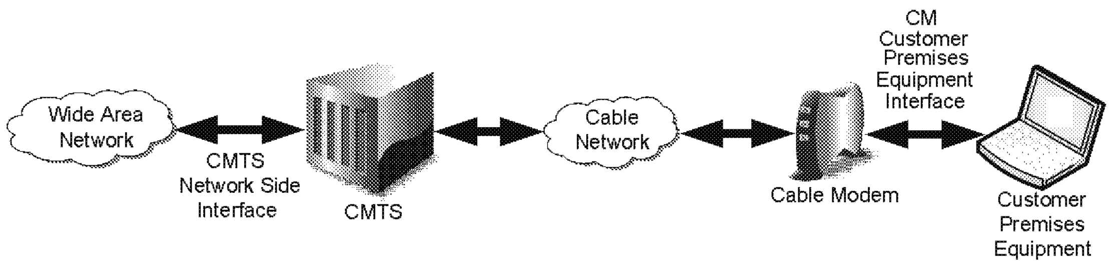

Figure 1-2 - Transparent IP Traffic Through the Data-Over-Cable System

1.2.4 Statement of Compatibility

This specification defines the DOCSIS 3.1 interface. Prior generations of DOCSIS were commonly referred to as the DOCSIS 1.0, 1.1, 2.0, and 3.0 interfaces. DOCSIS 3.1 is backward-compatible with equipment built to the previous specifications with the exception of DOCSIS 1.0 CMs. DOCSIS 3.1-compliant CMs interoperate seamlessly with DOCSIS 3.0, 2.0, 1.1, and 1.0 CMTSs. DOCSIS 3.1-compliant CMTSs seamlessly support DOCSIS 3.0, DOCSIS 2.0, and DOCSIS 1.1 CMs.

7.4.15.2.6 Allowed Values and Ranges for Configuration Parameters for Fine Ranging[38]

The CMTS MUST configure the fine ranging signal with the following limitations:The maximum number of subcarriers for the fine ranging signal (N_{fr}) is 256 subcarriers with 50 kHz subcarrier spacing not including the subcarriers in the guardband.

- The maximum number of subcarriers for the fine ranging signal (N_{fr}) is 512 subcarriers with 25 kHz subcarrier spacing not including the subcarriers in the guardband.
- The maximum preamble sequence size is 512 bits (64 Bytes) with both 50 kHz and 25 kHz subcarrier spacing.
- The number of preamble symbols (before duplication) is 1.

7.4.15.2.7 Power and Time Adjustments

Algorithms for power and time adjustments (such as number of fine ranging trials, frequency allocations, etc.) are vendor-specific implementation.

7.4.15.3 Probing

Probing is used during admission and steady state for pre-equalization configuration and periodic transmission power and time-shift ranging.

7.4.15.3.1 Probing Frame

A probing frame consists of K contiguous probing symbols (OFDM symbols), where K is the number of symbols in the minislot. The probing frame is aligned with the minislot boundaries in the time domain.

7.4.15.3.2 Probing Symbol Pilots

Probing symbol pilots are BPSK subcarriers, generated from the PRBS generation scheme described in Section 7.4.15.3.3.

The CM MUST use the generation scheme detailed in Section 7.4.15.3.3 to generate 2048/4096 subcarriers for 2K/4K FFT.

The CM MUST use the same BPSK modulation for a specific subcarrier in all probing symbols.

The CM MUST transmit zero valued subcarriers in exclusion subcarriers.

Probing symbol pilot i is always associated with the i-th subcarrier number, where:

$i = 0, 1, \dots, 2047$ for 2K FFT

and

$i = 0, 1, \dots, 4095$ for 4K FFT

(Subcarriers are numbered in ascending order starting from 0.)

7.4.15.3.3 PRBS generation scheme

The polynomial definition for the PRBS scheme is $X^{12} + X^9 + X^8 + X^5 + 1$, where the seed is 3071. The period of the PRBS is 2^{12}-1 bits, which is sufficient to create one probe symbol without repetitions. The sequence is illustrated in Figure 7-32.

The CM's linear feedback shift register MUST be clocked after every subcarrier starting at subcarrier 0, i.e., subcarrier with k=0 in the IDFT equation of Section 7.4.9.

[38] Revised per PHYv3.1-N-14.1210-1 on 12/11/14 by JB.

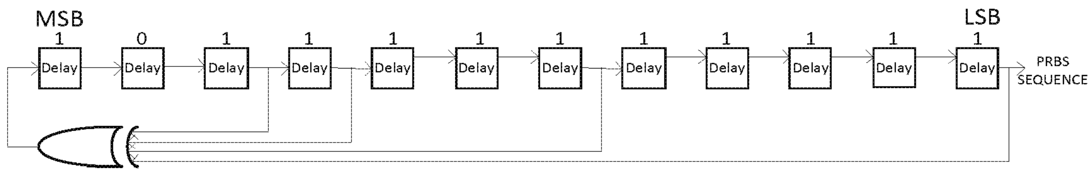

Figure 7-32 - Polynomial Sequence for Pseudorandom Binary Sequence Generation

The PRBS sequence for 4K FFT is:
1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 … 1 1 1 0 0 1 0 1 0 0 0 1 0 1

The PRBS sequence for 2K FFT is:
1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 … 0 0 1 0 0 1 1 0 0 0 0 0 1 1

The PRBS sequence is mapped to the BPSK pilots as follows:

0 is mapped to a BPSK pilot of 1

1 is mapped to a BPSK pilot of -1

7.4.15.3.4 Probing Information

The CMTS MUST allocate a specific probing symbol within the probing frame and instruct the CM to transmit the probing sequence in that symbol.

The CMTS MUST specify the probing symbol within the probing frame through the parameter "Symbol in Frame".

The CMTS MUST send three parameters to the CM: "st", "Start Subcarrier", and "Subcarrier Skipping".

The CM MUST support staggering pattern [DOCSIS MULPIv3.1] for probing, when the staggering bit "st" is set to one, when "st" is set to zero, the staggering is off.

The CMTS MUST define a probing pattern consisting of either the pilots from all the subcarriers of the assigned probing symbol, or a set of pilots from scattered subcarriers of the assigned probing symbol. Please refer to section 6.4.4 in [DOCSIS MULPIv3.1] for detailed probe mapping.

The range of "start subcarrier" is from 0 to 7. The range of "subcarrier skipping" is from 0 to 7. Figure 7-33 and Figure 7-34 illustrate the use of these parameters.

The CM MUST use the *start subcarrier* and *subcarrier skipping* parameters to determine which subcarriers are to be used for probing transmission, as follows:

- The "start subcarrier" parameter is the starting subcarrier number.
- The "subcarrier skipping" parameter is the number of subcarriers to be skipped between successive pilots. "Subcarrier skipping" = 0 implies no skipping of subcarriers (i.e., all subcarriers in a single symbol belong to a single transmitter).

The CM MUST NOT transmit the probing sequence using excluded subcarriers. Excluded subcarriers are those subcarriers in which no CM is allowed to transmit, generally because they are frequencies used by other systems (including guard-band subcarriers). The CM MUST transmit the probing sequence using both used and unused subcarriers.

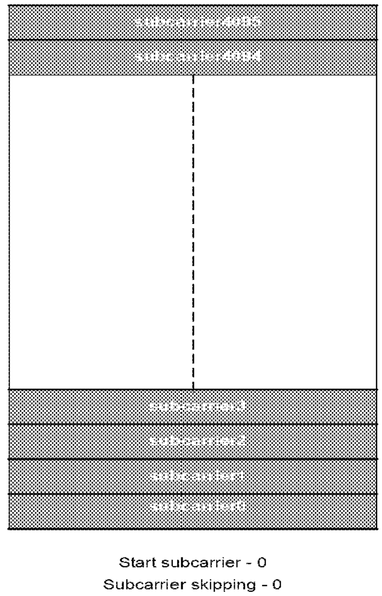

Figure 7-33 - 4K FFT Example, All Subcarriers Used for Probing, no Skipping

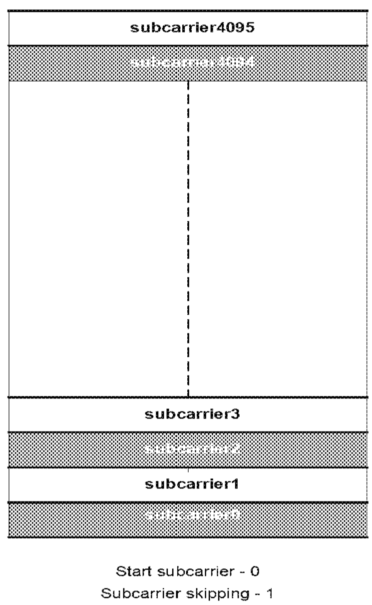

Figure 7-34 - 4K FFT Example, Alternate Subcarriers Used for Probing

The CMTS MUST NOT configure more than a single type of probe ("st", "Start Subcarrier", "Subcarrier Skipping" and PW value) on the same OFDMA frame per CM.

The CMTS MUST have the ability to scale the transmission power per subcarrier by configuring the PW bit in the P-IE [DOCSIS MULPIv3.1].

The CM MUST scale its transmission power per subcarrier when transmitting the probe as required by the CMTS in the P-IE [DOCSIS MULPIv3.1]. The range of the scaling values is Probedelta_n = -2 to -9 dB. See Section 7.4.12.3.